MODEL 600M RUGGEDIZED CHASSIS
USER'S MANUAL

Printed 1 January 1987

CODAR
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Codar Technology, Inc.
1500 Kansas Ave., Bldg. 2E
Longmont, CO 80501 USA
Telex No. 4947090
(303) 776-0472

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CUSTOM SYSTEM ADDENDUM

MODEL 600 SYSTEM CHASSIS

CUSTOMER:_____

Please note the following for your configuration:

If the system is equipped with a 11 series CPU the console port on the rear of the chassis is not active. The console will be connected to a DB-25 connector marked "CONSOLE" located within one of the standard DEC style knockouts on the upper rear of the chassis.

The auto-boot feature noted in the manual refers only to Microvax systems. Auto-boot may be implemented by the addition of a CTI Model 102 or by using a third party boot feature on a disk controller. Please note that only one may be used at a time.

The Model 600 series is compatible with Microvax Systems even if purchased with a 11 series CPU. Please contact Codar for recommendations on upgrading if desired.

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MODEL 600M CUSTOMER CONFIGURATION LIST

CPU TYPE

MicroVAX II: _____
LSI 11/73: _____

PURCHASE ORDER

Number: _____

LINE VOLTAGE

115 VAC: _____
208 VAC: _____
24 VDC: _____
48 VDC: _____

LINE FREQUENCY

50/60 Hz: _____
400 Hz: _____
50/60/400 Hz: _____
SPECIAL _____

POWER SUPPLY CONFIGURATION:

550 WATT Separate +5 and +12: _____
550 WATT Single Multi-output: _____
1100 WATT Dual Multi-output: _____
External Power Supply: _____

DISK DRIVE CONFIGURATION:

FIXED: _____
REMOVABLE: _____

EMI CONTROL

MIL-STD-461B: _____
TEMPEST: _____

REAR PANEL CONFIGURATION

Standard DEC I/O Plates: _____
Custom Connectors: _____
DB9 System Console: _____

ACCEPTANCE TEST PROCEDURES

Standard CTI: _____
Customer Specified: _____

MISCELLANEOUS

Elapsed Time Meter: _____
Warranty Start Date: _____

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SYSTEM & MODULE SERIAL NUMBERS

ITEM	MODEL #	SERIAL #	ADDRESS	VECTOR
600M Chassis:				
CPU:				
Memory #1:				
Memory #2:				
COM #1:				
COM #2:				
COM #3:				
Disk Cont. #1:				
Disk Cont. #2:				
TK50 Controller				
Disk Drive #1:				
Disk Drive #2:				
Disk Drive #3:				
Disk Drive #4:				
TK50 Tape Drive:				

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MODEL 600M RUGGEDIZED CHASSIS

1.0 GENERAL

This manual provides installation instructions and technical information on the 600M chassis. Please read this document carefully to insure that you are familiar with the general operation of the system.

This equipment contains potentially lethal AC voltages. Read and follow all warnings contained in this manual as well as the labels within the machine. Installation and maintenance should be performed only by individuals trained in such procedures.

Instructions in this manual assume that you have purchased a complete system including CPU, at least one disk drive and a DEC operating system. Chassis only customers may have to modify our procedures to suit their configuration.

Please read section 16.0 before proceeding. Section 16.0 discusses several decisions concerning configuration that you will eventually have to make.

1.1 UNPACKING

The 600M is packed in a special double box container. Please save the shipping box in which the 600M arrived. This box should be used in the event you should ever need to return the machine to CTI. Failure to use this box could result in shipping damage which will not be covered under warranty.

If any damage to the 600M is evident on receipt please retain all shipping material and notify CTI and the carrier within 48 hours.

1.2 INITIAL EXAMINATION

The Model 600M should be thoroughly inspected, following procedures in this manual, prior to application of AC power. Failure to do so could result in damage.

1.3 FRONT DOOR & TOP LID REMOVAL

The front panel can be opened by turning the four #10-32 captive stainless steel bolts in a counter clockwise direction. These bolts will disengage the front of the computer but remain captive in the machined front panel.

The door will now hinge down allowing access to the peripherals for inspection. The door can also be physically removed, after the four screws have been loosened, by lifting the door up and out of the machined hinge mechanism.

The top of the machine is removed by unscrewing 34 #6-32 stainless steel screws. The lid has a built in EMI gasket with compression stops. When reinstalling the lid, make two passes through the screws as the first ones tightened tend to loosen slightly due to compression of the gasket.

2.0 FIRST TIME SYSTEM TURN ON

The following procedure should be used when installing a new Model 600M. However, we recommend that you read this manual before proceeding in order to familiarize yourself with the individual functions.

1. Remove the machine's top cover.

2. Check that all modules are properly seated in the backplane.

3. Check that all power and I/O cables are firmly connected.

4. Place the lid back on top of the chassis (screws not required).

5. Connect a terminal to the rear panel system console connector. This is either a DB9 or MS connector or both (See section 11.1).

6. Install the supplied AC power cord and insert into an AC outlet.

7. Place the rear panel circuit breaker in the "ON" position.

8. Turn the front panel key lock to the middle position (key vertical).

9. Set the three front panel display toggle switches in the "UP" position.

10. Depress the front panel power switch.

11. Depress the front panel run switch.

12. The 600M will run internal CPU & memory diagnostics. Depending on the amount of memory, this could take several minutes.

13. In response to the prompt on the system console, type "B DU0".

14. The system will proceed to boot the operating system.

NOTE: The MicroVAX II CPU (KA630) can be set to either enter the console program or to "Auto-boot" a disk on power up. Your system has been configured to enter the console program on power-up. See section 5.0 for additional configuration information.

CAUTIONS: Do not insert any modules into the backplane with system power on as damage could occur to both the module and the system. Physically remove the rear panel power cord before opening or servicing the machine. Make sure your AC power line has a proper ground. Failure to provide a proper ground could result in a severe shock hazard in the event of an internal component failure. This machine is designed for military rather than commercial installations.

*** FRONT PANEL CONTROLS ***

3.0 KEY LOCK SWITCH

This switch has three positions which are unlabeled for security reasons.

3.0.1 OFF The first position is completely counter clockwise. In this position, the computer is turned off regardless of the rear circuit breaker or the front panel power switch.

3.0.2 RUN The middle position passes control to the front panel switches assuming that the rear panel AC circuit breaker is in the on position. All front panel switches are now active including power on/off. This would be considered the "normal" position.

If your going to lose your key, we hope that it happens when the key lock is in this position. You may also choose to not provide your customers with keys and simply leave the key lock in this position.

If you do lose the two supplied keys, replacements can be obtained from CTI or from EAO, the switch manufacturer.

3.0.3 LOCK The third position is completely clockwise. In this position all of the front panel switches are deactivated. However, control reverts to a set of default conditions; POWER ON and RUN. This is the "Power and go" mode as on application of AC line power (or after a power failure) the system will normally auto-boot into the run mode. This mode is useful if you do not want the system tampered with by others.

We suggest that you try all three switch positions. You can force power failures at the same time by using the rear panel circuit breaker while watching how the system responds.

3.1 POWER SWITCH

This is a locking switch that controls system primary AC power. Depressing this switch turns on the AC power assuming the rear panel circuit breaker is in the "ON" position. A light in the switch is also illuminated, if DC power is within an acceptable range. Pressing the switch again turns the AC power off.

This switch controls a solid state AC relay which in turn actually controls the AC power to the system power supplies.

3.2 BOOT (RESTART) SWITCH

This is a momentary contact switch. Depressing it causes the system to "reboot". This is accomplished by using the DEC technique of simulating a power failure using the backplane DCOK line.

3.3 RUN SWITCH

Depressing this locking switch to the in (on) position places the CPU in the run mode and illuminates its integral run light if the CPU is configured to enter the console program on power-up. If the CPU is set for auto-boot, the RUN/HALT switch will have no effect. (See section 5.0).

In the out position, the run light goes out, the computer halts and the CPU normally reverts to DEC's console program.

In normal operation, the RUN switch should be on.

3.4 BATTLE OVERRIDE SWITCH

This is a momentary switch with an internal LED indicator. The function of this switch is to disable the 600M's internal protection logic against problems such as low/high AC line voltage or high internal temperatures. When enabled, the switch's internal LED is on and the computer is in the battle override mode of operation.

It is normally armed only during critical periods, such as combat. It allows the computer to attempt to work under difficult environmental and power conditions. However, internal damage to the computer or peripherals may occur under these conditions. Damage to the computer due to operation in the battle override condition is not covered by the system's warranty. Depressing the switch in it self will not cause any system damage.

In normal operation, battle override should be off (LED not illuminated).

3.5 SYSTEM FAULT INDICATOR

This indicator is illuminated if the Power Control Module (PCM) has turned off primary AC power (via a solid state AC relay) due to a problem such as low/high AC line voltage or high internal temperatures. This light derives its power from an independent small power supply. Thus, it can be on even if the system primary AC power is off. (The rear panel circuit breaker must be "ON".)

The exact reason for the shutdown can be determined by examining the five LEDs on the internal Power Control Module. See section 9.0 and the silk screening on the PCM.

3.6 FRONT PANEL ALPHANUMERIC DISPLAY

The 600M provides a 16 digit alphanumeric display for diagnostic purposes. This display is controlled by three miniature toggle switches located between the display itself and the elapsed time meter. The default mode for these switches is with all three in the "up" position.

3.6.1 AUTO-SEQUENCE In this mode, the display will auto sequence through the following system parameters;

1. **TEMPERATURE #1 (Ambient Air)**
2. **TEMPERATURE #2 (Power Supply Heat Sink)**
3. **TEMPERATURE #3 (Card Cage Air)**
4. **NOT USED**
5. **NOT USED**
6. **AC LINE VOLTAGE (RMS)**
7. **+5 VOLT POWER SUPPLY**
8. **+12 VOLT POWER SUPPLY**

3.6.2 CONTINUOUS DISPLAY Moving the right hand switch to the "down" position will lock the display on the current channel. Data for this channel will continue to be updated. Moving this switch back to the "up" position will place the display back in the auto sequence mode.

3.6.3 DATE & TIME DISPLAY Placing the middle switch in the "down" position will display the current date and time in military format. This switch has priority over the other two switches. In this mode the left and right switches have no effect.

The left hand switch is not used on standard production 600Ms. It is designated for use with custom display software.

NOTE: The diagnostic display depends on the presence of the 600M's main +5 volt supply. If the +5 volts fails completely or is turned off by PCM logic, the display will go blank. However, this condition will be indicated by illumination of the front panel "fault" indicator. See section 13.

3.6.4 ADDITIONAL CAPABILITIES

The front panel display is part of a larger subassembly called the PCM, or power control module. The PCM is discussed in greater detail in sections 9.0 and 12.0.

The PCM contains a Z8 microprocessor which runs the 16 digit display discussed in the preceeding section. It also provides a serial port which can be used to set the date and time from the MicroVAX or an external terminal. This technology is derived from a stand alone Q-Bus module we manufacture called the Model 170 Q-Monitor.

The PCM is capable of performing a large variety of functions above those discussed in this manual. As an example, unused analog and digital channels can be monitored, logged and displayed on the front panel or to the MicroVAX.

Due to the large number of possible configurations, we have chosen to only implement the front panel display and date and time functions. Please contact us if you would like additional information concerning these "hidden" capabilities. We can also provide you with a copy of the Q-Monitor manual which will provide a good starting point concerning capabilities.

3.7 ELAPSED TIME METER

This hermetically sealed military meter is mounted on the front panel and shows total AC power up time with a maximum indication of 9,999 hours or about 14 months. It is non-resetable and will roll over to 0,000 hours and continue automatically after 9,999 hours. As an example, 11,500 hours will be displayed as 1500 due to the roll over which occurred at 9,999.

The elapsed time meter on a new system will normally show 100+ hours due to complete system testing prior to shipment. This is in addition to test time performed on the individual subassemblies.

4.0 BACKPLANE CONFIGURATION

The 600M is supplied with a 14 slot backplane with 0.6" board spacing. Color coded card guides are used to identify the backplane slots along with decals inside the 600M.

Slot # 1 A, B, C & D is reserved for the MicroVAX II CPU module (KA630). This slot is identified by red card guides and is next to the power supply module on the right side of the machine - not the left side of the machine.

Slots 2 & 3, C & D are wired to slot # 1 using the "C-D" bus interconnect for MicroVAX II memory modules. These slots are identified with yellow card guides on the C-D side of the backplane. Slots 2 & 3, A & B are wired as standard Q-Bus. Blue or white card guides are used on the A-B side of slots 2 & 3.

All remaining slots are wired with the Q-Bus in the A-B and C-D connector locations. Alternating blue and white card guides are used to help simplify module insertion.

NOTE: Modules are installed with components facing the right hand side of the machine as viewed from the front. You can verify this by checking that notches on the connector edge of the Q-Bus module line up with tabs on the backplane connectors. Boards will not go in backwards but you could cause physical damage.

4.1 BUS INTERRUPT PRIORITY

The bus interrupt structure flows from 1 A-B to 2 A-B to 3 A-B to 4 A-B to 4 C-D to 5 C-D to 5 A-B to 6 A-B to 6 C-D to 7 C-D etc. Thus, the structure is a serpentine after it passes the three MicroVAX memory slots.

You must insure that the bus interrupt structure is maintained up to the last module in the backplane. Any empty slots must be filled with bus grant boards. We can provide either dual or quad wide modules for this purpose.

Bus grant cards are not required in empty slots after the last module in the system. Do not install bus grant cards in unused C-D slots (slot #2, C-D or slot #3, C-D).

4.2 SLOT UTILIZATION

Slot # 1 A-B-C-D is reserved for the quad wide MicroVAX II CPU module. Alternately, an 11/73 can be installed in slot # 1 A-B with C-D unused. DEC 11/23 and 11/83 CPUs can also be used - please contact CTI.

Slots # 2 & 3 are normally used for quad wide MicroVAX II memory modules. (If only one memory module is used it must be in slot # 2 next to the CPU module). Alternately, dual wide Q-Bus modules can be installed in slots 2 & 3, A-B with the C-D slots unused.

The remaining 11 slots can be used for either quad or dual wide Q-Bus modules.

NOTE: Certain quad wide modules are designed to pick up the Q-Bus from A-B and only power from C-D. Thus, they could be used in slot 2 and/or 3 if not occupied with a memory module. If you try this with the wrong module, damage could occur to the back plane or the module - be careful.

4.3 UNUSED SLOTS

We recommend that all unused slots be filled with bus grant cards. This prevents two potential problems:

1. Under sustained vibration it is possible that an empty card edge connector could short internally, due to DEC's mechanical connector design.

2. Empty connectors could also be shorted if something dropped inside during maintenance. (It does happen!)

5.0 MicroVAX II SWITCH CONFIGURATION

This section provides information on how to configure the MicroVAX II CPU (KA630 module). Commercial DEC systems handle the system configuration through the use of a CK-KA630-A CPU distribution panel which mounts on the rear panel of the DEC BA box and connects to the CPU via a ribbon cable.

The 600M provides the CK-KA630-A functions on its internal power control module (PCM). The PCM is covered by a clear plexiglass cover which allows inspection of the board without disassembly.

A ten switch DIP package (labeled SW1) is provided on the PCM for KA630 configuration. This switch package duplicates the DEC CK-KA630-A switch functions exactly. Switch functions are;

SWITCH #1	HALT ENABLE	CTI DEFAULT
OFF	Halts Disabled	
ON	Halts Enabled	X

SWITCHES #2-4			CONSOLE BAUD RATE	CTI DEFAULT
2	3	4		
OFF	OFF	OFF	300	
ON	OFF	OFF	600	
OFF	ON	OFF	1200	
ON	ON	OFF	2400	
OFF	OFF	ON	4800	
ON	OFF	ON	9600	X
OFF	ON	ON	19200	
ON	ON	ON	38400	

SWITCHES #5-6		CONSOLE POWER-UP MODE	CTI DEFAULT
5	6		
OFF	OFF	Normal	X
ON	OFF	Language Inquiry Mode	
OFF	ON	Loop-Back Test Mode (Maintenance)	
ON	ON	DEC Manufacturing Use Only	

SWITCHES #7-8		KA630-A MODULE CONFIGURATION	CTI DEFAULT
7	8		
OFF	OFF	Arbiter	X
ON	OFF	Auxiliary #1	
OFF	ON	Auxiliary #2	
ON	ON	Auxiliary #3	

SWITCHES #9-10		BOOT AND DIAGNOSTIC CODE	CTI DEFAULT
9	10		
OFF	OFF	Send Only	
ON	OFF	Normal	X
OFF	ON	Loop-Back Test Mode (Maintenance)	
ON	ON	Illegal State (DO NOT USE)	

HALT ENABLE: In the "ON" position halting of the CPU is enabled. This means that either the run/halt switch on the front panel or the break key on a terminal can halt the CPU. On power-up, the CPU will enter the console program and wait for you to type "B DU0" to boot the machine. It will not auto-boot a disk drive in this mode.

In the "OFF" position the CPU can not be halted from the front panel or from a terminal. On the other hand, the CPU will auto-boot a system device. This is accomplished using a "sniffer boot". The system tries to boot peripherals in the following order:

1. **MSCP Disk Drive.**
2. **TK50 Tape Drive.**
3. **MRV11 Prom Module.**
4. **DEQNA Ethernet Controller.**

You may wish to change this switch to the "OFF" position which will enable auto-booting.

CONSOLE BAUD RATE: This switch controls the baud rate of the single line serial console port on the KA630 CPU.

CONSOLE POWER-UP MODE: These two switches are read by software in the KA630 boot PROM at power-up or following a "restart". In the "normal" mode the system checks for a valid date and time and then executes diagnostics. These switches should be left in the "normal" mode.

KA630 MODULE CONFIGURATION: These switches determine wether the CPU is the arbiter or one of three auxiliary processors. (Yes you can have multiple CPUs on one bus but DEC does not support it with software). These switches should always be in the "arbiter" mode with a single CPU.

BOOT AND DIAGNOSTIC CODE: These switches should be left in the "normal" position. They are used in conjunction with DEC diagnostic routines.

Detailed technical information on the MicroVAX II CPU module is available in DEC publication EK-KA630-UG, "MicroVAX 630 CPU Module User's Guide". Copies are available from the DEC Direct group at 1-800-258-1710 for $40.00 per copy.

6.0 FRONT DOOR EMI GASKET

The front door is gasketed to the main chassis using a silicone/monel EMI gasket. This gasket can be removed by simply prying it out of the machined grove. The ends of the gasket are glued together using a cyanoacrylic adhesive.

This gasket will normally never need replacing as it is rated for about 500 full compression closings of the door. If you do ever need to replace it, remember that the silicone rubber part of the gasket faces the outside of the door (environmental seal).

6.1 FRONT DOOR HONEYCOMB EMI FILTER

This filter provides excellent EMI suppression due to its construction and the use of tin plated aluminum (rather than irridited aluminum). The honeycomb is gasketed to the front door using a Monel/Neoprene flat gasket which is permanently attached to the honeycomb assembly.

The honeycomb's flat EMI gasket has integral compression stops. These prevent over-compression of the EMI gasket when reinstalling the honeycomb to the front panel. In extremely high vibration environments, you may want to coat the screws with Loctite thread locking compound during re-installation.

6.2 AIR FILTER

The front door honeycomb EMI filter is covered by an expanded Monel metal screen which serves as a dust filter. There is also room between the honeycomb and the front panel louvers for an optional foam air filter.

The honeycomb EMI/air filter is removed by removing 16 #6-32 screws on the front panel. The integral dust filter can then be vacuumed and/or rinsed in soapy water. Do not use solvents as they may attack the paint and/or EMI gasket.

6.3 BACKPLANE AIR FLOW

We recommend that you evenly distribute modules across the fourteen available slots (MicroVAX II memory must go next to the CPU). Any empty slots can be filled with bus grant cards. The result is even air flow and reduced component temperatures.

6.4 SYSTEM COOLING

Cooling is provided by three 120 CFM 12 Volt DC fans. Fan RPM is monitored by the front panel display microprocessor. Air is pulled in from the front of the machine and discharged through the honeycomb EMI filter on the rear panel.

Due to the air flow design, cooling is substantially reduced when the top cover is removed. Do not run the 600M for extended periods with the top removed.

Operation with a dirty air filter will also result in reduced cooling and higher than normal internal temperatures.

7.0 INTERNAL PERIPHERALS

The 600M will hold either four "nonremovable" or three quick release removable 5 1/4" peripherals. Normally, one of the available units is a TK50 cartridge tape, with the remaining units disk drives.

We supply all installed disk drives pre-formatted and tested. Your system software is also loaded on unit 0 as part of our testing and for your convenience.

Under normal conditions, your system will boot properly on delivery. However, some customers choose to reformat their disk drives as part of final installation. This eliminates any potential problems due to severe shock during shipping and handling. We recommend that you allow the disk drives to warm up for at least 15 minutes prior to formatting.

Instructions on formatting are contained in your disk drive controller manual. If you should have problems, please contact our customer service department.

7.1 REMOVABLE DRIVES

Up to three removable drives can be installed in the 600M if at least one removable drive is ordered initially (otherwise a fixed peripheral assembly is supplied). Each disk drive is supplied in a canister with a quick release I/O connector.

Drives are removed by turning the locking screw counter clockwise and pulling the drive straight out. Handle the drive canister with caution to prevent shock damage.

The TK50 is also supplied in a canister, primarily for maintenance. A ribbon cable must be manually disconnected from the rear of the TK50 as it is removed from the 600M.

8.0 AC INPUT VOLTAGE

The 600M is designed for operation on 50/60 Hz, 95 to 138 VAC single phase power. Operation on 400 Hz, 50/60/400 Hz or 220VAC is available as an option. Your specific configuration is described on the rear panel name plate and the inside front cover of this manual.

8.1 AC POWER INPUT CONNECTOR

AC power is applied via a MS3102A10SL-03P male rear panel connector. We supply a power cord with a matching MS3106A10SL-03S female connector and MS3057-4A cable clamp. Connections are as follows;

PIN A = HOT (Black wire)
PIN B = NEUTRAL (White wire)
PIN C = GREEN (Ground)

We frequently see installations with defective (or missing) AC grounds. This can result in a severe safety hazard. This condition also can prevent our internal EMI line filters from working properly. **MAKE SURE YOU HAVE A GOOD AC GROUND!.**

8.2 CHASSIS GROUND

A 1/4 x 20 brass stud is provided on the rear panel for grounding the chassis to your rack frame. We recommend that you use heavy braided cable for this purpose, if required in your installation.

8.3 AC CIRCUIT BREAKER

A sealed rear panel military circuit breaker controls AC power to the system. It is activated by a toggle switch handle labeled "on/off". This breaker overrides the front panel power "on/off" switch. It must be in the "ON" position for the computer to work.

In the event of an internal electrical problem, the breaker will trip to the "OFF" position. It can be rest by returning the handle to the "ON" position. If it trips again, discontinue use of the system until proper serving can be obtained.

The most common reason for a tripped breaker is a defective power supply. Another possible cause is that a transient suppressor has fired and effectively shorted the AC input as a protective measure which in turn trips the breaker.

8.4 POWER SUPPLIES

The standard Model 600M provides 550 watts of DC power using two separate fully regulated supplies;

1. **+5 Volts @ 74 Amps (370 watts)**
2. **+12 Volts @ 15 Amps (180 watts)**

The 600M is also available with a single multiple output 550 watt supply. This unit is normally used in conjunction with a second supply to provide 1100 watts of DC power. On dual supply systems, one supply feeds even numbered backplane slots and the other odd numbered slots.

Your specific configuration is listed on the inside cover of this manual.

8.5 DC POWER COLOR CODES

All DC power wiring within the Model 600M follows the following convention:

1. **RED = +5 Volts**
2. **ORANGE = +12 Volts**
3. **BLACK = Ground**

This color code is also used on the pin housings of the power connectors.

8.6 MicroVAX II BATTERY BACKUP

The KA630 CPU module includes (in one I.C.) a calendar clock and CMOS RAM. (DEC calls it a "TOY" for Time Of Year). DEC uses three NICAD batteries to provide 10 days of guaranteed power off operation of these devices. The MicroVAX II can function in the event that battery backup is not present (or fails) as it checks for a valid date and time on boot-up.

Ten days is extremely marginal compared to other available calendar clocks which provide up to four years of power down operation (our Model 120 or the calendar clock on the Model 600's power control module).

The NICADS are located inside the top cover of the power supply modules. See section for service information 14.4.

8.7 FAN POWER

The 600M uses three 12 volt DC fans. Power for these fans is provided from a two position barrier strip (TB1) mounted on the top rear surface of the power control module.

Fan wiring follows our system color code: orange is +12V and black is ground. Legends are silk screened next to TB1.

9.0 POWER CONTROL MODULE STATUS LEDs

This board is mounted on top of the peripheral assembly inside the chassis. It is protected by a plexiglass cover plate which allows visual inspection of switches and LEDs.

The five LEDS provide indication of specific fault conditions. In the event logic on the PCM shuts the machine down, a LED will light indicating the fault condition. This is possible due to the fact that the PCM runs on a separate small power supply. The LEDs are identified as follows:

1. **DC Low (+5V or +12V).**
2. **DC High (+5V or +12V).**
3. **AC Line Voltage High.**
4. **AC Line Voltage Low.**
5. **High Temperature.**

As you face the machine from the front, LED #1 is on your left and LED #5 is on your right. In normal operation, none of the LEDS are illuminated except for briefly during power on or off sequences. The function of each LED is silk screened on the PCM plexiglass cover plate.

The dip switch package SW1 on the PCM controls various modes of operation within the MicroVAX II (KA630) module. The function of these switches is identical to the dip switch provided on a panel with standard MicroVAX II systems. See section 5.0.

9.1 CABLE KEYING & IDENTIFICATION

The majority of internal cables, including all power cables, are keyed to insure proper insertion. Other cables are marked with identifying color dots to insure proper insertion.

All cables are identified with a CTI partnumber. The ends of the cables are also identified with "TO/FROM" designators.

10.0 RACK MOUNTING

The 600M is supplied with standard RETMA rack slides. Spacer plates are provided for use behind the 600M's rack ears to prevent interference with the rack slide mounting hardware. Certain configurations are also supplied with rear panel shock pin assemblies.

The rack slides are fastened to the sides of the 600M using 5 #10-32 3/8" stainless steel bolts per side. **NOTE:** The bolt length is critical - be careful when substituting other hardware. Read section 14.0.

Our standard slide length is 22" unless otherwise specified in your purchase order. Extensions are provided for use in deeper racks.

10.1 SHOCK MOUNTS

The peripheral tray is shock mounted to the chassis using Aeroflex wire military mounts. Two shock mounts are used on the top of the peripheral assembly as snubbers against the main chassis.

The peripheral tray is mounted to the floor of the chassis using either four or six Aeroflex mounts depending on total peripheral weight. Four floor mounts are used with any combination of three or less peripherals. Six floor mounts are used with any combination of four peripherals or to stiffen the system response with 1,2 or 3 peripherals.

Our standard shock mounts are designed to provide protection against three dimensional shocks in the 20-25 G range. Stiffer shocks are available which will handle higher G inputs but at the expense of increased shock to the peripherals. The 600M's standard shocks will reduce input shock by about a factor of five (20G's input, 4G's to the peripherals).

The limiting factor is the amount of shock mount travel which is limited by the diameter of the shock mount which is in turn limited by three directional "space" within the chassis.

10.2 CHEMICAL THREAD LOCKING

Many of the screws in the 600M are retained using a mild Loctite chemical thread locking compound (Loctite 222). In some cases, this may result in the screws being slightly difficult to remove (intentional). If necessary, the bond can be broken by applying heat from a soldering iron to the screw.

Loctite should be used when reinstalling these screws. Loctite is anaerobic. It sets due to an absence of oxygen on the screw thread when installed. Any excess that is exposed should be removed with a paper towel as it will not set up.

10.3 HARDWARE

All screws, Pem nuts, washers and nuts are stainless steel. Included with your system is an assortment of spare stainless steel screws and lock washers. Please do not use regular steel or cadmium platted steel hardware as corrosion may occur in certain environments.

10.4 METAL FINISH

Critical aluminum parts are plated with tin over nickel over copper. This finish provides excellent conductivity and corrosion resistance. This finish also insures compatibility with the Monel metal used in the EMI filters.

Exterior surfaces are finished with a surface primer followed by a two part urethane paint to Federal Standard 595 colors.

Surfaces can be cleaned with 409 or Windex or similar mild cleaners. Chemical solvents, such as acetone, should not be used.

11.0 REAR PANEL CONFIGURATION

The 600M is available with two different rear panels;

1. **Custom I/O to your specifications.**
2. **Standard for developmental use.**

The 600M is normally supplied with the rear panel punched to accept specific connectors as specified by you. In order to simplify your development, we also offer a rear panel with knockouts for four standard DEC I/O panels plus a fifth oversize slotted panel for ribbon cable egress.

We can provide additional rear panels as your program develops. You are not locked into the specific rear panel as delivered with your system. Contact our customer service group for assistance.

11.1 REAR PANEL CONNECTORS

Connector J32 is a 22 pin female MS38999 series III, part number D38999/20/FC35SN. A mating male D38999/26/FC35PN connector with pins and a Glenair M85049/38-13-A back shell is provided with each machine. This connector provides system console I/O as listed below:

J32 WIRING

PIN #	FUNCTION
1	MicroVAX Serial Line Out To Terminal.
2	Ground.
3	MicroVAX Serial Line In From Terminal.

Pins 20, 21 and 22 are used for communication with the PCM Z8 for setting date and time. See section 15.0. The remaining pins are unwired and reserved used for special I/O to the PCM or for customer use.

Standard rear panels also have a MicroVAX II style male (pin) filtered DB9, J33, which provides system console lines in parallel with J32, the MS38999 connector. This connector is wired as follows;

J33 WIRING

PIN #	FUNCTION
1.	CABLE SHIELD.
2.	TRANSMIT FROM MicroVAX (receive on terminal end).
3.	RECEIVE TO MicroVAX (transmit on terminal end).
7.	SIGNAL GROUND.

A standard DEC I/O cable will work on this connector. If your home made cable does not work, reverse pins 2 & 3 at one end of the cable and try again.

NOTE: Pins 20,21 & 22 are used to connect to the serial port on the Power Control Module. This port is used for setting the date and time on the front panel display, an infrequent procedure. See section 15.0. Basically, you need two cables. One for the system console and one for talking to the PCM, when required. There are other ways to accomplish this - contact CTI for assistance.

Make sure you have your terminal properly configured. The default MicroVAX II system console configuration is as listed below:

BAUD RATE = 9600
DATA BITS = 8
STOP BITS = 1
PARITY = DISABLED

NOTE: The serial port can be the major source of EMI leakage from within the computer. Make sure you use a well shielded cable to the terminal. Emissions due to external cables are your responsibility.

12.0 THEORY OF OPERATION

This section will discuss the overall operational concept of the Model 600M.

AC power is applied to the rear of the machine through an MS connector. From here it passes through a double pole magnetic military circuit breaker and on to the system line filter. The input section is in a sealed container to prevent radiation between the line filter and the power connector. The EMI line filter provides suppression to the requirements of MIL-STD-461B.

The AC next passes several MOV line transient suppressors. At this point it splits into two paths. The primary flow is into a solid state AC relay and onto the system power supplies. The 115 VAC is fully contained within the power supply assembly.

AC also flows into two small transformers. The first transformer provides a low AC voltage which is used as an indication of AC line voltage and power fail by the power control module (PCM).

The second transformer provides AC at 0.1 amps to a small DC supply on the power control module (PCM). This supply runs the power control module and is on any time the rear panel circuit breaker is on, regardless of the state of the front panel AC power switch.

The front panel power switch controls the solid state relay via logic on the PCM. This signal enters the power supply assembly through a 15 pin DB connector. AC from the power supply assembly to the PCM also flows through this connector.

By using a separate wide input range supply, the PCM is able to continuously monitor system status. Improper input voltage or high temperature will result in the PCM shutting off main system power. This circuitry is basically disabled by the battle short switch.

The PCM provides a variety of control signals to the system. These include;

1. **Backplane DCOK**
2. **Backplane POK**
3. **Backplane RUN/HALT**
4. **Backplane LTC (Line Time Clock)**
5. **Solid State Relay AC Power Control**
6. **MicroVAX Configuration Switches (10 Lines)**
7. **Front Panel Indicators**
8. **Rear Panel Status**

Part of the PCM is used for the 16 digit alphanumeric front panel diagnostic display. This logic is controlled by a Z8 microprocessor in conjunction with three serial ports, a calendar clock, digital parallel port, CMOS RAM and eight channel A/D.

13.0 GENERAL

The 600M requires no scheduled maintenance with the exception of the front panel air filter, the MicroVAX NICAD batteries (if used) and a lithium cell on the power control module.

Air filter cleaning is strictly dependent on the environment. The filter can be examined through the front panel slots.

In dirty environments, the backplane modules should be inspected for dirt build up when the front panel air filter is cleaned. Modules do not need to be removed for inspection - dirt build up will be obvious. The main problem with dirt on the modules is that it reduces air flow and increases component temperatures.

Three NICAD cells are used to provide standby power for the calendar clock which is built in to the KA630 CPU module. These batteries are located in a holder on the inside surface of the top cover on the power supply module.

We recommend that these batteries be replaced every 18 months based on an expected life of 24 to 36 months.

The power control module contains a single lithium "coin" battery. This cell has a standby life of eight years and a continuous backup life of about two years. We recommend replacement at 18 month intervals. If the 600M spends most of its time with power on, replacement can be extended to four years.

A defective lithium cell will result in the front panel display not showing the correct time following a power failure. The MicroVAX system will not be affected.

Failure of the NICADS will result in the MicroVAX not having the proper time on boot. However, the system will still function.

NOTE: Your application software and operating system will determine the actual effect of loss of time.

13.1 ERROR CONDITIONS

1. If the front panel fault light comes on, the system has shut the main AC power off due to a fault condition. The system fault condition can be determined by examining the 5 red LEDS on the internal power control module. Section 9.0 describes each of the five LEDs.

2. Minor problems will be displayed by the 16 digit alphanumeric display.

3. The MicroVAX II CPU has a five digit LED display on the edge of the board. During power up, the CPU counts down in binary through various test on the four red LEDs. On successfully completion, the four red LEDS go out and the green LED comes on. This may take several minutes depending on how much memory is in the system.

4. If nothing abnormal is observed on the various LEDS and indicators the problem is probably external - a defective terminal or terminal cable.

5. If the MicroVAX green LED does not come on the problem may be with a backplane module, CPU or memory. Try removing all nonessential modules (with the system turned off!) and then re-booting.

6. Failure to boot may indicate a defective system disk drive, disk cable or a bad disk format. Try reformatting the system disk.

7. Incorrect time on the front panel display could be due to either handling of the power control module (the oscillator stopped temporarily) or due to a depleted lithium battery. The lithium cell should read about 3.1 volts.

8. Incorrect VMS system time can be caused by defective NICADS. A fully charged three cell pack should measure about 3.6 volts.

9. If the front panel display is off and the system fault light is on you have no +5 volts due to either a defective supply or the PCM turning off the AC line voltage for a variety of reasons.

10. In general, +12 is used by the disk drives and some logic modules. Check to make sure it is between 11.8 and 12.2 volts.

13.2 SYSTEM SHUT DOWN CONDITIONS

The 600M will shut down for any of the following conditions:

1. Ambient temperature greater than 50 C.
2. Power supply heat sink temperature greater than 80 C.
3. Card cage temperature greater than 50 C.
4. AC line voltage less than 95 Volts.
5. AC line voltage greater than 135 Volts.
6. +5 volt supply greater than +5.4 volts or less than +4.6 volts.
7. +12 volts greater than +13 volts or less than +11 volts.

The battle short switch can be used to effectively over ride the voltage and temperature sensors as part of your test procedure.

14.0 GENERAL

This section provides information on removing major sub-sections of the 600M. These include the power supply assembly, the card cage and the shock mounted disk assembly. The 600M consists of these three major Line Replaceable Units (LRUs).

Please note the following items before proceeding:

1. The rear panel power cord must be disconnected from the 600M before working on the machine. Turning off the front panel power switch and/or the rear panel circuit breaker is not sufficient. Failure to do so could result in your becoming a statistic.

2. Certain screws in the 600M are critical in length. Re-installation with the wrong length could damage internal items in the 600M. The following screws are particularly critical:

   A. The last three #10 rack slide screws on the right side of the machine as viewed from the front of the 600M. Use of over length screws will result in deformation of the side of the internal power supply assembly.

   B. The bottom lip of the rear panel is secured to the main chassis using #8 3/8" flat head screws. As viewed from the rear of the 600M, the first 3 screws on the left are critical in length. Over length screws will run into the bottom of the AC input EMI "Dog house". Deformation of the "Dog house" sheet metal will occur.

Remember to use star lock washers under any bolt that is not secured with Loctite.

14.1 FIXED DISK DRIVE REMOVAL

This procedure is used to remove a "nonremovable" fixed peripheral.

1. Remove the system's front door.

2. Remove the three screws from each of the two hinge assemblies.

3. Disconnect all cables running from the power control module to the power supply assembly, the card cage/modules, and the rear panel.

4. Remove the two cables from the power control module to the front panel switches and display.

5. Remove the front snout from the 600M (8 #6-32 and 8 #8-32 screws). (Screws holding the switch panel assembly do not need to be removed.)

6. Remove all screws from the bottom and sides of the main chassis which secure the Aeroflex wire shock mounts. **NOTE:** Your machine may have either four or six bottom shocks plus the two on the sides. You may need to use slight heating to break the Loctite bond.

7. The entire peripheral assembly can now be removed.

8. The peripherals are secured with screws from the top and bottom of the peripheral cage assembly. Access holes are provided. However, the power control module must be removed to provide access to the top screws.

9. The power control board is secured with 6 #6-32 screws into standoffs. It is not necessary to remove cabling from the peripherals to the power control module - the PCM can be pivoted out of the way to provide access.

This procedure requires about 25 minutes.

14.2 POWER SUPPLY ASSEMBLY REMOVAL

1. Turn the system power off and remove the AC line cord.

2. Remove the four plug in connectors from the top of the power supply assembly.

3. Remove the two fan wires from TB1 on top of the power supply assembly.

4. Remove the 6 #6-32 screws from the rear panel that secure the power supply assembly to the rear panel. Do not remove the 6 screws that hold the actual circuit breaker and AC connector to the power supply assembly.

5. Remove the rear panel from the machine after disconnecting any I/O cables (18 #8-32 screws on the rear and 9 #8-32 screws from the bottom).

6. Remove the 4 #8-32 screws on the right side of the chassis that secure the power supply assembly to the side of the chassis.

7. Remove the 4 #8-32 screws from the bottom of the chassis that secure the power supply assembly. **CAUTION:** The power supply assembly weighs 20 pounds and is now loose in the chassis.

8. The power supply assembly can now be removed thru the rear of the chassis although it may be a slightly tight fit due to the rear right side flange. If needed, outward pressure can be applied to the right side panel to provide more clearance. Alternately, the card cage can be loosened and slid over slightly.

This procedure requires approximately 15 minutes. All connectors are keyed and color coded which will simplify installation of a new power supply assembly. Make sure you follow the color coding on the fan wires to TB1.

14.3 CARD CAGE REMOVAL

1. Turn the system power off and remove the AC line cord.

2. Disconnect the two DC backplane power connectors from the top of the power supply assembly. (These connectors are released by squeezing the side extensions.)

3. Disconnect the backplane control cable from the power control board. This is a small cable that runs between the front of the card cage and the power control board.

4. Remove all modules from the backplane. **CAUTION:** The MicroVAX II is extremely static sensitive. Take appropriate ESD precautions with all modules. Static damage is not covered under our (or DEC's) warranty

5. Remove the horizontal metal spacer bar (square aluminum tubing) between the card cage and the left side panel of the chassis. This is secured through the left side of the chassis with 4 #6-32 screws.

6. Remove the 6 #8-32 screws from the bottom of the chassis which secure the card cage to the floor. The card cage is now free.

This procedure requires approximately 13 minutes.

14.4 NICAD BATTERY REPLACEMENT

Replacement NICADS are available from CTI. Suitable units are available from Eveready, part number CH15. We recommend that you replace the NICADS at 18 to 24 month intervals. Be sure to record a new installation date on the label on top of the power supply assembly.

1. Turn the system power off and remove the AC line cord.

2. Remove the 8 #6-32 screws holding the top cover on the power supply assembly. These are located toward each corner of the plate. **NOTE:** Do not remove the four screws toward the center of the plate.

3. The plate can now be lifted about 3 inches and turned over.

4. The NICAD battery holder is bolted to the bottom of this plate. The plate can not be completely removed due to two wires which run from the battery holder into the power supply.

5. Remove the old batteries from the holder and install three new cells. **NOTE:** Watch the polarity of the new cells. Make sure they are installed correctly or damage could occur.

CAUTION: Replace only with NICAD batteries. Do not use alkaline or lithium units. Lithium units may explode due to the charging currents.

BATTERY FORMING: We cycle all NICADS thru two charge/discharge cycles to eliminate any potential "memory problems". This procedure optimizes battery life. If you choose to provide your own replacement batteries, please contact our technical support group for assistance.

14.5 LITHIUM BATTERY REPLACEMENT

The power control module contains a single lithium "coin" battery. This battery will require replacement at two to eight year intervals depending on use.

1. Turn the system power off and remove the line cord.

2. Remove the clear plexiglass plate which covers the power control module (six #6-32 screws).

3. The battery is located in a black holder on the PCM. Note that the top of the battery is marked with a "+" sign.

4. Remove the battery by gently prying up on the metal retaining clip. **NOTE:** Use a non-conductive widget to prevent shorting the battery.

5. Install a new Saft LM2425 or equivalent battery while observing the correct polarity.

6. Replace the plexiglass cover over the PCM. Make sure all screws are accounted for.

7. Install the line cord and turn the system power on. Set the correct time using the procedure in section 15.0.

8. Turn the system off and back on in order to verify that the system maintains the correct time during a power outage.

CAUTION: Make sure that you have not dropped anything conductive onto the PCM prior to turning power on.

CAUTION: Dispose of the old lithium cell carefully. Do not crush as lithium itself can cause severe burns. Do not burn as the old cell may explode violently.

15.0 SETTING THE 600M CALENDAR CLOCK

The PCM provides a complete CMOS calendar clock with lithium battery backup. The date and time can be displayed on the front panel alphanumeric display. Date and time display is enabled by depressing the middle toggle switch on the front panel to the right of the display. This calendar clock is independent of the MicroVAX II calendar clock.

Communication with the calendar clock is via a serial port connected to the PCM's Z8 microprocessor. Using this port, you can either read or set the date and time from an external terminal or via a serial port on the MicroVAX II. Communication parameters for the Z8's serial port are:

1. **9600 baud full duplex.**
2. **8 data bits.**
3. **Parity disabled.**

Connection to this port can be made as follows:

1. A special CTI cable which plugs into connector J4 on the PCM with a DB25 on the other end (contact CTI).

2. The rear panel 38999 connector, J32.

4. A cable between the PCM and a serial port on the CPU. This requires software support on your end.

Pin connections for J32, the 38999 are:

PIN #	FUNCTION
22	**TRANSMIT FROM Z8 (receive on terminal end)**
20	**RECEIVE TO Z8 (transmit on terminal end)**
21	**SIGNAL GROUND**

Communications can be verified by typing the "Break" key on the terminal. The Z8 will respond with the letters "QM" when everything is working properly. Please proceed as follows using only capital letters:

1. Hit the "Break key".
2. The Z8 will respond with "**QM_**".
3. Type an "**S**" followed by a return.
4. The Z8 will respond with "**QMsetup_**".
5. On the same line, set the date & time using the following format;

   "**SET CLOCK DOW DD-MMM-YY HH:MM:SS**" followed by a return

6. The Z8 will respond wi "**QMsetup_**".
7. Type "**SAVE**" followed by a return.
8. The Z8 will respond with "**QMsetup_**".
9. Either reenter the date or hit the "**escape**" key if finished.
10. The Z8 will respond with "**QM_**".
9. Type a "**P**" to proceed - thats it.

"DOW" is the day of the week using the first three letters of the day, MON, TUE etc. "MMM" is the first three letters of the month, JAN, FEB etc. You can leave off "DOW" or "DOW" and "DD-MMM-YY". "HH" is in military format, 0-23. The front panel display format is "YYMMDD HH:MM:SS".

The calendar clock can also be used in an elapsed time mode since power on. This is also the default mode if incorrect time and date data is detected by the microprocessor. Contact CTI for additional information.

The "SAVE" in step #7 is used to load the new date and time permanently into the calendar clock. Otherwise, the date and time will be lost following a power failure and the display will revert to an elapsed time mode.

16.0 CONFIGURATION DECISIONS

As delivered, your system is operational. However, there are several items which will require your attention to insure an efficient installation. Make sure that the following items are addressed by the appropriate personal:

*** SIMPLE DECISIONS ***

1. On power-up will the system auto-boot or enter the console program? This also effects the front panel RUN/HALT switch. See section 5.0.

2. Will the front panel be enabled or disabled by the key lock switch? See section 3.0.

3. Small amounts of CMOS non-volitale RAM is included on both the KA630 MicroVAX II CPU module and our Power Control Module. This may present a problem when handling secret data. Contact CTI for assistance.

*** ADVANCED DECISIONS ***

4. The MicroVAX II CPU can read all functions displayed on our 16 digit front panel display by using a serial port. This will require special internal cabling from CTI and software support by you. See section 11.1 & 15.0 and contact CTI.

5. The front panel calendar clock is set via an RS232 cable and terminal connected to a rear panel connector. This requires an external cable with special pin connections as the rear panel connector is shared with the console terminal. The clock can also be set (and read) from the CPU using simple software on your end. See section 15.0 for cabling requirements. Contact CTI if you would like to do this from software.

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